Emergence and growth of broadband in the French Info-communications System of Innovation (FISI)

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INTRODUCTION

In this chapter, we focus on the emergence and growth of broadband in France. The issue is concerned with important questions in the domain of industrial dynamics. Broadband is of course related to the mature telecommunications industry, since one of the major competitor in this activity is the incumbent telecoms operator, France Telecom. In this perspective, the emergence and growth of broadband is deemed to be highly determined by the role that France Telecom has played/still plays within the French Info-communications System of Innovation (FISI). But broadband is also a radically new activity, supported by a new technological trajectory that significantly changes the FISI, and thus requires a deeper investigation.

Emergence and growth of broadband is also connected to important challenges in the domain of international competitiveness. The one who takes the lead in this global competition will play a decisive role for the future of the information society. If we consider various indicators given in the introduction of the book[1] on the development of broadband, on the one hand, France has a medium ranking for penetration and price but, on the other hand, French operators (incumbents or entrants) are absent in the ranking of the top 10 providing the highest capacity/speed. This unequal development of broadband is a general characteristic of European countries, and contributes to explain why Europe lags behind Asia and North America. Essentially the fact that major European companies (except for Swedish and Belgian companies) are not at the core of the global competition appears as a major weakness in the position of Europe. In that respect, France is an interesting case: though within the medium

[1] See Introduction by Martin Fransman.

ranking of Europe, France performs nevertheless better than Germany, the UK or Italy, and still progresses up in the ranking.

In that paper, we will essentially decompose the industrial dynamics of the French broadband industry. We argue, however, that innovation and the emergence of a new industrial dynamics do not come only from companies, but are also highly influenced by the info-communications system of innovation that prevails at the national level. In the line of a series of recent contributions, we think that innovation and industrial dynamics are linked with the development of a combined process of change involving supporting institutions such as regulation, standardization and competition authorities, as well as government agencies and policies (Pavitt, 2001; Nelson, 2004; Metcalfe, 1995; Fransman, 1994, 2002, 2004; Antonelli, 2001, 2003; Saviotti, 1996, 2001; Witt, 2003; Krafft, 2003, 2004).

The purpose of that paper is thus to analyse how industrial dynamics in the domain of broadband articulates with the FISI. We first define broadband, in order to specify the boundaries of the industry (in reference to a good – broadband access – and its associated services), as well as the relative strengths and weaknesses of broadband in France over time, compared to other European countries (Section 1). We then concentrate on one of the key features of industrial dynamics, namely the competition that lies between technologies and between firms (Section 2). We further relate this industrial dynamics to one key dimension of the FISI, the regulatory framework (Section 3). We consider the fact that this regulatory framework is itself highly dependent on the legal framework and judicial procedure that makes all the FISI gradually develop and change (Section 4). In all these sections, we will also note, however, that there are still elements in the FISI that presumably cannot change in a near future, since they are characterized by important path-dependencies, historically- or

geographically-related, that strongly shape how this innovation is developed and used. Last section will conclude.

1. DEFINING BROADBAND

Broadband today still has a very large definition. By broadband, French regulation and competition authorities generally mean Internet connexions that are higher than 128kbit/s. Of course, the choice of the threshold between broadband and narrowband Internet can greatly affect the boundaries of the industry as well as results in comparative performance, especially if other countries fix the threshold at a higher level[2]. Finally, this definition is greatly evolving over time. Since technology is changing so rapidly, what was considered as broadband yesterday can turn out to be narrowband today.

Difficulties in defining broadband involves that reference is now more often made to the spectrum of related services, and Internet-user applications. Only a few Mbit/s per second are necessary for real time video, some tens of kbit/s are sufficient to listen to music, especially radios over the Internet. Navigation on the web and e-mail require also a few Mbit/s, but broadband also greatly enhances comfort.

In practice, however, traditional criteria still contribute to characterize broadband, such as availability, penetration, capacity/speed, tariffs, etc. In this paragraph, these different criteria are presented and informed on the basis of more recent data collected from annual reports of the French regulator ART (Autorité de Régulation des Télécommunications) and other complementary information sources (Observatory of Internet Uses, Médiamétrie, etc.). All the

[2] More technically, narrowband Internet regroups 0.5 mbps for a traffic volume of 1 million minutes, while Broadband Internet requires 23 mbps to meet the requirements of 1000 subscribers.

data tend to show that though France is not one of the top leaders, it gradually progresses to the position of a European leader.

1.1. Availability

Availability can characterize essentially two different things. Availability can express the fact that anyone willing to connect to the Internet can do it whatever the place of connexion. Availability in this sense is progressing very quickly, since 45% of the French population can be considered as Internet users. In 2004, Observatory of Internet Uses, Observatory of Multimedia equipment, and Mediametrie converge to show that 23.1 (20.2 in 2003) million of French citizens aged 11 and over claimed to have connected to the Internet in the last month. But availability also means that Internet users have a personal connexion at home (29.2% of the French population, compared to 27.7% in 2003). This of course involves that they own a computer (29% in 2004, compared to 27.7% in 2003). Almost anyone having computer also has thus an Internet access.

The type of Internet connexion has changed also very quickly. Narrowband Internet users first reached a peak at the end of 2002 - beginning of 2003, but are gradually decreasing thereafter. ART, in its annual report in 2004, shows that narrowdand subscriptions declined by 15% compared to 2003. On the other hand, the number of broadband users has raised at spectacular growth rates until the very last months, involving a multiplication by 6 of broadband subscriptions in the period 2002-2004.

1.2. Penetration

We now consider more precisely broadband penetration, namely the percentage of households having a broadband connection at home. Though France used to be below the European

average in terms of broadband penetration rate, demand for broadband services starts to rise very sharply in 2004.

XXXXXX Insert Exhibit 1 here XXXXXX

The number of broadband Internet subscribers actually grew by more than 120% to over 3.5 million Internet users versus 1.6 million earlier. ADSL has the lion's share of this market with over 3 million customers at the end of 2003. The numbers of cable subscribers rose by only 1/3 as much, by around 40%.

This sudden public enthusiasm is partly due to a very appreciable fall in access price (a fall of over 30% for a 512kbps connection for instance), following a price war initiated by the different Internet service providers in the broadband market and the diversification of offers (higher bit rates for an equivalent price). The emergence of "triple play" offers associating Internet access, TV over ADSL and voice over ADSL, can also be mentioned as an important element that favoured broadband subscriptions.

1.3. Capacity/Speed

Capacity and speed depend on the Internet applications one can have access (e-mail, real-time video, music), but also on the Internet users themselves (Business or residential). On the one hand, the business market is highly segmented. In 2004, it generated revenues estimated at 0.62 billion dollars (PPP: 0.897), excluding very high bit rates provided on optical fibre. On the other hand, the residential broadband market generates revenues of around 1.86 billion dollars (PPP: 0.897), of which 85% comes from ADSL technology and 10% from cable. In any case, demand for bandwith has literally exploded since 2003, jumping from 30% to 90%

of demands in 2004 (cf. ART annual report 2004), and confirming thus an increasing use of broadband access.

1.4. Tariffs

Broadband tariffs are often unrelated to the temporal length of connection. This is one of the basic differences with narrowband that was based on the classic commuted telephone network, and was thus dependent on conventional modes of pricing. Nevertheless, these fixed-price contracts for unlimited connexion also co-exist with other offers that are limited in time (for instance 20 hours connexion) and or in volume of exchanged data (5 Go of downloaded data). These offers are dedicated to bring the former customer base of narrowband to broadband, and to manage the technological shift smoothly. The price for narrowband has thus declined from 50 dollars in 1999 (PPP: 0.928) to 18 dollars in 2004 (PPP: 0.897). In the meantime, 1024 kbit/s broadband access is offered at 40 dollars (PPP: 0.897) compared to 68 dollars (PPP: 0.910) in 2003.

1.5. Variety of suppliers: shared access or unbundling?

The rapid development of broadband Internet in 2003 is also due to the rise of shared access in France, which is also present in the Netherlands and the Scandinavian countries – one of the most advanced European countries in broadband. Alternatively, full unbundling is higher in Germany, Italy, Denmark and Finland than in France.

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2. COMPETITION

We know that competition, and especially competition between technologies is a key element shaping industrial dynamics. Important contributions in the domain have extensively referred to technological innovation (product and process innovation) as a key driver in the evolution of industries (Klepper, 1997). But, in a larger context, we also have to acknowledge that competition primarily takes place among heterogeneous firms using a large range of actions aimed at ensuring the realisation of the choices of a given firm, while restraining at the same time the sphere of actions of its rivals. These actions can be related to technology, but can also concern productive resources (human, physical, financial), as well as the implementation of new forms of organization in which customers, suppliers, partners and even competitors may be involved (Krafft, 2000; Fransman, 2001).

In the present analysis of the emergence and growth of broadband in France, it will be argued that the disruptive competition that took place between technologies, and more importantly between companies supporting these technologies, generated increasing financial difficulties and turbulences, as well as the decline of the initial developers of broadband, the first (cable) movers. This situation also drove to the unequal development of broadband, both geographically and technologically, that stimulated the emergence of a new actor in the process of competition, namely the intervention of local public authorities.

2.1. Competition between technologies

Broadband Internet can be provided via different networks, and one of the motivations to be expected from the emergence of this innovation was to increase competition between technologies. More precisely, what was intended was a decisive contest of the incumbent's

technology (DSL networks) with other, alternative technologies supported by new entrants (such as cable, one of the initial technology ever providing broadband; or more advanced technologies such as satellite, optical fibres, Wifi, Wimax, Radio local loop, 3G).

Fierce competition thus occurred between these technologies. The outcome of this fierce competition is that in France, as in half of the European countries, technologies other than DSL still account for a very low share of the market. Annual report of ART shows that in 2004 only five countries (among which the UK, the Netherlands and Austria) out of fifteen rely on alternative technologies (other than DSL) as a dominant source for broadband access. This fact can be interpreted as the definitive domination of DSL, and that at the end of the day competition provided by other technologies is not so great in France (which uses DSL at 85%, and alternative technologies at 15%), as well as in most of the European countries. This can also suggest that the process of disruptive competition undertaken so far urgently has to be inflected towards more coordination to sustain the development of alternative, emergent technologies. The introduction of a fierce competition between technologies led to the following contradiction. The incumbent's technology was intended to be contested, but this technology finally dominates all the other competing technologies. This *de facto* dominant technology is neither the optimal one (such as the large spectrum of advanced technologies) nor the initial one (such as cable). Today, the outcome of this competition in technologies can thus be summarized by the following features.

2.1.1. ADSL develops faster

DSL technologies, with 3,043,800 broadband subscribers, have developed faster, presumably because 1) it was the main technology of the incumbent, the company that has developed the larger broadband network; 2) major competitors essentially tried to copy the incumbent's

strategy in the early phases of the introduction of competition on broadband in the phase of disruptive competition; 3) DSL was also the main technology of the French equipment supplier, Alcatel, and more generally of all the traditional equipment suppliers. For these reasons, DSL technologies finally won the competition in technologies. Thus, while the initial motivation of regulation was to increase the variety in technologies, there has been quite rapidly a convergence towards the domination of this technology.

2.1.2. Cable started quickly but stagnates today

Cable, with 393,800 broadband subscribers, is the second means of large-scale broadband access. In France, cable networks have always been considered as a major alternative infrastructure for the supply of telecoms services, and this is why since 1998, they were largely developed all over the country. Cable technology has three major handicaps that have slow down its gradual progression: 1) cable operators are still carrying unpaid debt from the cable plan initiated in 1982 and need to invest heavily to develop new services and upgrade old networks; 2) allocation of network operation licenses led to a fragmentation of operating areas throughout the country, preventing economies of scale; 3) regulatory constraints, such as a maximum coverage fixed at 8 million of customers have further exacerbated the difficulties of the sector. Today, cable clearly stagnates in France compared to other countries. The central position of FT in cable activities, combined with the fact that it faces disruptive competition on ADSL, contributes to explain why cable did not develop to a sufficient level to compete with other infrastructures owned by the historical operator.

2.1.3. UMTS was significantly delayed

Back in January 1998, France was insisting on the vital importance of UMTS for promoting the information society and the telecoms industry. By pressing for candidate selection using

the "beauty contest" method and suggesting a reduction in the financial terms in view of what occurred in other countries, France encouraged the emergence of factors allowing a third operator to apply for a licence. Hence, at the end of 2002, three operators competed in 3G: France Telecom-Orange, Cegetel-SFR, and Bouygues Telecom. This four-year process was marked with profound hesitations, and uncertainties, that still delay the development of the technology. Very early on, in fact in 2001, France officially declared that the timetables for launch of UMTS services were over-optimistic. GPRS was seen as the essential link in the transition between 2G and 3G, since it allowed users, business or private to be acquainted with new services combining mobility and data transmission. But, in the meantime, GPRS offered low speeds and relatively poor services, and the relatively slow take off that was finally observed for this technology did not favour the subsequent success of 3G.

2.1.4. Wifi and WWL are lagging behind

Other technologies, such as Wifi, WWL, satellite and FTTH are lagging behind. First, because the decision to liberalise the rolling-out of some of these technologies was rather late. It is only in 2002 that France took steps to the development of wireless local area (WLAN), commonly called Wifi. France only confirmed in 2003 the objective to complete gradually the national coverage, so as to allow wider use in both urban and rural environments. Prior to that decision, 2.4 GHz band were exclusively used for military/defence purposes. Second, difficult economic conditions in the telecoms sector in 2002, the lack of maturity in the 3.5 GHz band and the cost of equipment in the 26GHz band have all impeded WLL development. WLL, however, is complementary to Wifi, notably for connection of access point, since it can be used to transport high speed data and as a means of Internet access for small and medium-sized companies. Thirdly, the economic model that will give private users access to a broadband offering under satisfactory tariff conditions on the basis of satellite is still to be

developed. Finally, other technologies, such as FTTH (Fibre To The Home) and powerline carrier systems, play only a marginal role in terms of broadband subscriptions.

2.2. Competition between companies

In the distribution between the incumbent and the new entrants' market shares, France occupies a medium range in the classification of European countries. More precisely, France Telecom is dominant (with 57%), but new entrants can be considered as active players (with 43%). Compared to UK, Sweden or Belgium in which the incumbent's market share ranges from 30 to 50 %, penetration of new entrants in France is thus much lower. In the meantime, France performs better than Germany or Italy where the dominance of the incumbent is in general superior to 60% in market shares.

In the meantime, however, neither the French incumbent nor the entrants can be considered as key players in the global competition of the broadband Internet. How can we explain this paradox: liberalization and competition is progressing within the national frontiers, but does not foster the position of the French companies in the international competition? Various reasons can be exposed, some related to the disruptive competition that prevailed among players in ADSL, other related to a certain kind of distortion of competition in cable due to the participation of the incumbent into the capital of its competitors.

2.2.1. Disruptive competition involved financial difficulties

Today, the wholesale market is composed of five essential operators: France Telecom (57%), Iliad-Free (17%), Telecom Italia-Alice (8%), LDCom (5%) and Cegetel (5%). These five essential operators are thus facilities-based and provide broadband access. At the retail level, we have seven essential companies: France Telecom-Wanadoo (52%), Free (17%), AOL

France (8%), Tiscali (5%), Noos (5%), T-online/Club-Internet (4%), Neuf Telecom (2%), Tele 2 (2%). These companies are facilities-based for some of them (the one which also operate at the wholesale level), but their essential activity is to resell broadband access and services.

The essential strategy of these companies was driven by the introduction of a disruptive competition. All the companies (the first mover was Illiad-Free) initially followed a pricing strategy where price does not cover short run marginal costs. More recently, some of the companies (Free, again) proposed an advanced offer for broadband access and services (called the Free Box) combining broadband Internet access, Voice on IP, and access to information content (television and video on demand). At the moment, the result of this disruptive competition whatever the form that it has taken is that, except Free, most of the companies are running into financial difficulties that highly question their long term viability.

2.2.2. Disruptive competition generated increasing turbulence

During the first two years of liberalization, entry was an easy, common phenomenon in the French telecommunications industry. However, the number of firms started to stagnate in 2000, and even declined in 2001. In 2002, exits were largely superior to entries, leading to a negative net entry. This period 2000-2002 corresponds to the development of broadband activities in France, and especially to the introduction of competition in the local loop access for voice, data and the Internet. The procedure of allocation of licenses for radio local loop operators that occurred in 2000 clearly attracted a lot of new companies (many of them entered in 1999). Most of these companies (more than 60%) exited only a few months after entry, either because they did not obtained the license or because they went into important financial troubles with the financial crash.

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The process of entry that occurred on the local loop access was intended to develop an alternative technology (namely radio local loop) that could be considered at that time as one of the more promising alternative technology, and also as one possibility to limit the monopoly exerted by the incumbent on this activity.

However, the largely uncoordinated process of entry that actually took place – combined with the fact that this process of entry coincided with the financial crash – clearly resulted into an increasing turbulence at the firm and industry level.

2.2.3. Distortion of competition and the decline of the first (cable) movers

At the end of the 1990s, cable was considered in most advanced countries as one of main architecture that could compete on the local loop with the historical operator. In this perspective, large mergers and acquisitions were engaged in most countries. For instance, in Europe, France Telecom invested in the UK cable company NTL and in Casema in the Netherlands. In the US, AT&T acquired a couple of cable operators to restore its own local loop which was sold in 1984. These costly acquisitions were engaged during the boom period of the telecoms industry and, when the bubble deflated in 2000, were clearly perceived as inefficient strategies. AT&T invested more than 100 billion dollars in these M&As and, with the weight of debt, soon had to sell the cable assets to its competitor Comcast. France Telecom also had to get out of Casema's capital for the same reasons.

Often, countries in which the Internet penetration was the largest are also countries where competition between ADSL and cable was stimulated. For instance, in the US, the UK, Belgium, and most of the north European countries (Sweden, Denmark, the Netherlands), cable operators have kept large market shares, at least comparable, and to some extent superior than ADSL companies. France appears as a paradoxical case. Though cable was one of the first technologies supporting broadband Internet access, the use of this technology is still very limited today. In 1998, 13,464 Internet subscribers subscribed their Internet connection through cable operators. Since then, the number of subscribers has grown regularly but at a very lower speed compared to ADSL (+40% for cable in 2003, against +100% for ADSL). Alternatively, in the Netherlands, penetration rate of cable represents 22% of Internet connexions, and ADSL 20%. In Sweden, 10% of the connexions occur via cable and 33% via ADSL. Global coverage in these countries ranges from 70% to 95%, while it is only 25% in France.

One argument explaining why cable is lagging behind ADSL technologies is certainly the lack of technical maturity. Many experts and actors of the industry say that this could change in a near future with the development of new offers. End users often kept in mind a separation with, on the one hand, telecommunications services (telephone and Internet) offered by telecoms operators and, on the other hand, value added television services offered by cable operators. New offers, such as “Triple play”, could favour the convergence between telecommunications and television

Another argument is that the French incumbent operator, France Telecom, has a large participation in the capital of competitors Noos, NC Numéricable, and UPC France. France Telecom has a dominant position in cable in France: it owns 100% of France Telecom Cable,

70% of the essential facilities used by NC Numericable, 27% of Noos. This means that FT owns either directly or indirectly 40% of the capital of cable operators. This reveals that this certain type of distortion of competition induced very low incentives to develop the cable technology.

2.2.4. Innovation, disruptive competition and distorted competition

Competition among players in the broadband industry either seems to be over-amplified (in the case ADSL) or under-developed (in the case of cable). In any case, this involves inadequate incentives for the development of innovation in the industry. Firstly, because disruptive competition tends to expose companies to an excessive financial risk, especially in the period of the deflated bubble. Secondly, because distorted competition exists in the domain of alternative technologies, leading to a very low probability to stimulate the development of these technologies.

The assessment of the current situation in the broadband industry shows that 'more competition' in terms of an increasing number of companies and technologies, often prone in conventional economic models, is not necessarily beneficial to the society in the long run, and especially to the emergence of innovation. Moreover, it seems that leaving competition in the industry work out for itself is not a sensible strategy. Rather, the type of interaction that exists among companies has to be checked and eventually corrected by regulation or competition authorities. Moreover, the effective development of a technological diversity or variety has to be guarantied.

2.3. Emergence of a potential new actor: local public authorities

Activities related to the info-communications have exploded in the last few years in France, and generated a multiplicity of new companies. The geographic location of these companies, however, remains highly unequally distributed, and reveals the irregular development of broadband. There is large dominance by Ile de France (Paris) where most of the broadband activities (as well as other related activities such as hardware and software, electronics, test and control, etc.) are concentrated. Then there is a group of medium-sized areas, such as Provence Alpes Côte d'Azur (PACA), and Rhône Alpes; and further group of smaller areas, such as Aquitaine and Bretagne.

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This disparity thus claims for a strong political intervention, such as the recent measures on the 'digital divide' promoted by the government and the regulator. The challenge is to create conditions encouraging geographical expansion of broadband access offerings based on various types of technologies, and at affordable prices to allow all users, even those leaving in isolated rural regions, to benefit from the competitive dynamism observed in the more densely populated urban areas (Krafft, 2004).

Preliminary reflections to consider local public authorities as potential new actors in the broadband telecommunications industry emerged in 2002, at a time when market players were having increasing difficulty with financial constraints. Telecommunications services are crucial for enhancing the attractiveness of cities and regions. Local authorities are now fully aware of the importance of providing digital technologies to citizens, particularly as a way of fostering economic growth and development. Given this structural trend but also the specific

economic difficulties facing broadband companies today that forced them to select more cautiously their investments, many local authorities have been motivated to test their capacity to establish and operate telecommunications networks. Some already have taken initiatives, notably in the field of broadband access using alternative technologies such as cables, Wifi, Wimax, optical fibres or FTTH.

In a sense, to avoid the unequal development of digital technology and services throughout the country, public intervention in both offers and services is becoming a necessity in the ongoing – sometimes chaotic – process of competition. With the government programme against the 'digital divide'[3], the legal framework allows, since 2003, that local authorities can assist private businesses in developing their activities, by taking financial responsibility for most onerous network construction costs. This new legislation states that local authorities can create, but also operate telecommunications networks. Further developments would allow local authorities to provide telecommunications services where private initiatives are inadequate to satisfy the requirements of business or private users.

Of course, such a new player could not come out of the sole market forces that are traditionally intended to shape industrial dynamics. More adequately, important decision at the regulation and institutional level were necessary, involving that industrial dynamics of the French broadband Internet has now to be intrinsically related to the FISI.

[3] In French, la « fracture numérique ».

3. REGULATION

Competition and regulation are distinct, yet connected, fields of economic policy. Competition generally applies in industries the functioning of which tends to be compatible with 'normal', i.e. fair and equal, rivalry. Regulation operates in sectors where normal rivalry cannot be guarantied, for instance in sectors were high fixed/sunk costs dominate, or in sectors that were recently liberalized.

Competition and regulation also differ in terms of procedures. While competition authorities are limited to the compatibility of firms' activities in respect with the law, regulation authorities presumably have a greater scope of intervention. For instance, they can control and impose certain prices, investment strategies, and productive choices to firms. Moreover, most of the time they act *ex ante*, and not *ex post* as in competition policy; and their action is not occasional but rather long term.

Finally, while competition is often based on oligopoly theory, regulation is mostly inspired by agency models where the principal is the regulation authority and the agent the incumbent company. In this perspective, one of the key difficulty is to reduce the gap between the interests of the regulator (which may be resolute or weak), and the interests of the incumbent (which may be pro-active or inert, see Motta, 2004; Hausman, 1997).

In various countries, the assessment today is that regulation was often based on wrong assumptions about the future development of the telecoms and broadband activities. Regulation thus either imposed unrealistic purposes to the incumbent, leading to increasing difficulties (uncoordinated strategies, high level of debt, massive process of mergers and

acquisition, etc.), or left the incumbent in a comfortable situation with very few requirements (Fransman, 2002).

In France, the regulator was increasingly inspired by the broadband success observed in countries such as Japan and Korea. In that perspective, the French regulator (ART) increased, in a first step full facilities-based competition (2000-2002), encouraging the development of alternative, competing networks. In a second step (2002-), the regulator introduced aggressive policies on unbundling and insisted that the incumbent had to charge very low price to competitors wanting to use its local access network.

3.1. Full facilities-based competition

The first step in the regulator's plan was to favour a full facilities-based competition, by the entry of a large number of new firms (around 50) that were supposed to develop their own network. For most of these companies, the usual strategy was to obtain a licence to operate at the local or regional level, for instance in large urban centres, that could be extended later to a national licence. Many new US or European operators were among these new entering companies, such as 21st Century, 360 Networks, Winstar, Titan, Iaxis, and Dynegy, and thus applied for a local or experimental licence. This wave of entry was also composed of a number of cable operators that could also provide alternative networks and were thus considered as credible competitors.

From the regulator's side, the large entry process was considered as a positive thing, since entry is often used as a vehicle for introducing new innovations, while the absence of entry is generally associated with technological stagnation. Also, entry is considered as a strong mechanism for getting prices right in markets, as well as for getting product and process

specifications right. From the companys' side, entry in the French broadband industry was a logical step in their expansion in Europe, especially because at the time of entry (2001-2002), broadband was still under-developped in France and could thus be characterized by high potential profit opportunities in a near future.

This first step in the regulator's strategy did not really provide the expected results, however. Firstly, because the demand for broadband did not really take off at this time. Until the end of 2002, demand for broadband still remained stagnant and operators that entered two or three years earlier could not develop adequately their business strategy. Secondly, the financial crash that occurred in 2000 clearly questioned the viability of these companies that relied on stock markets or bank loans to finance their infrastructure project.

3.2. Aggressive policy on unbundling

The turning point for broadband access came thus in the second half of 2002, with acceleration in growth of the number of residential subscribers. In one year, the number of subscribers multiplied by 2.5, making the French market the fastest growing in Europe, with 1.7 million broadband Internet users (ADSL + cable). At the end 2002, broadband access represented 18% of all Internet access subscriptions. In 2004 (See ART, 2004), total number of broadband subscribers was 3,346,800, to be decomposed into 393,800 for cable and 3,043,800 for ADSL.

Three different options (termed as "option 1", "option 3", and "option 5"[4]) were defined by ART concerning ADSL unbundling, leaving different roles in the access and collection of broadband traffic to France Telecom and alternative operators. These options reflect the

[4] Note that there are no Options 2 and 4.

increasing introduction of competition in the broadband market, namely unbundling, shared access, and wholesale or full unbundling, and consist in the aggressive policy on unbundling developed by ART.

Option 1 corresponds to unbundled local loop, where all the access and collection of DSL traffic is operated by competitors of FT. This option concerns, in 2004, 275,600 subscriptions. Option 3 corresponds to "shared access", and characterizes the situation where France telecom is the essential provider of the local loop, but the access and collection of DSL traffic at the national level is left to alternative operators. Here 100,000 subscribers were concerned in 2004.

Option 5 corresponds to "wholesale", i.e., a situation of monopoly by France Telecom on the local loop and also at the national level of the access and collection of DSL traffic. This represents 1,738,000 subscribers for France Telecom-Wanadoo and 928,600 for other ISPs.

Decisions by ART in April and July 2002 concerning copper pair unbundling (option 1), collection and transport (option 3) and France Telecom resale offers (option 5) had a helpful impact. These decisions contributed to create favourable conditions for the emergence of a more diversified offering and a decline in prices, leading a larger number of customers to use the Internet. ART focused particularly on ADSL, in both retail and wholesale markets, for two reasons. First, it was the dominant broadband access technology, and secondly, strong market growth on a competitive basis implied that alternative operators could use the access network (copper pairs) owned by the incumbent operator, France Telecom, through the local loop unbundling.

The main objective was to improve operating conditions for unbundling and service quality in densely populated areas and encourage access migration from option 5 to option 1, and from option 3 to option 1. Another objective was to expand the geographical coverage of ADSL to serve the greatest number of users in large towns and in less densely populated areas. The last objective was to give new impetus to resale offers by improving economic terms of option 3, particularly paying attention to the risk of a price squeeze with option 5.

ART's actions in this field were reinforced by the European Commission's New Regulatory Framework created by transposition of European directives. Wholesale supply of unbundled access (including shared access) to loops and sub-loops on copper pairs is in fact one of the relevant markets pre-defined by the European Commission in which ART can impose interconnection and access obligations on operators with significant market power.

4. LEGAL FRAMEWORK AND JUDICIAL PROCEDURES

The new legal framework created by the European directives defines the general objectives and regulatory principles that should guide the action of the member states and the national regulatory authorities (NRAs). Each NISI in Europe had thus to adapt to this common legal framework, and to find its own way to respect European requirements. For the regulator, this essentially led to important changes in the sphere of action, as well as major adjustments both internally and externally.

4.1. Europe's new regulatory framework: from regulation to competition

The goal of the new legal framework created by the European directives is to foster and consolidate competition in the electronic communications sector markets. To perform this task, regulation must adapt to changes in each markets, increasingly using the tools and concepts of competition law. Hence, while maintaining sector-specific regulation, this new framework lays the ground work for the transition towards gradual application of competition law as the sole reference governing the sector. Once a market has become competitive, *a priori* sector regulation has to be replaced by *a posteriori* competition law.

This means, first, that regulation has to apply in "relevant markets"[5]. Regulators have then to designate the operator(s) exercising significant influence in a market when it enjoys a position equivalent to dominance within the meaning of competition law. If the answer is yes, then the operator(s) is considered as having a significant market power. In this case the regulator has to decide whether to maintain, eliminate or modify the obligations of these operators so as to remedy failures of competition in the market. Regulation is a priori confined to sectors where competition is not yet sufficiently well established and concerns primarily the wholesale markets. Retail markets are only subject to regulation at a later stage if regulation of the wholesale markets upstream is not sufficient to ensure competition in the downstream retail markets. Second, the objective of the "telecom package" imposes that regulation has to take technological convergence into consideration and examines under unique notification procedure the establishment of public network and supply of a public electronic

[5] This includes demand side and supply-side substitutability for the definition of market is terms of product and services, as well as for the geographical definition of the market.

communications service regardless of the technical platform used (cable, microwave, wireline).

The other aspect regulation has to adapt is the increasing concentration in the sector and the emergence of players with a European or International dimension. This naturally leads the regulator to re-orientate its scope of activities. The attendant risk of this movement is the creation of virtual oligopolies that the regulator has now to tackle seriously. Likewise, technological changes, and notably the convergence between fixed, mobile telephony, the Internet and the audiovisual sector are opening up new market segments, and bringing about a new distribution of network and service functions. The internationalisation of service providers and the fact that many of them are installed outside national boundaries, calls for a European or even International approach. The regulator cannot confine its analysis to the domestic market without running the risk of leaving out a whole section of the market. Nevertheless, national regulatory authorities must remain attentive to the specific features of their own domestic markets and seek to uphold competition while continuing to encourage investments in new networks. This apparent contradiction actually illustrates the importance of the harmonisation/subsidiarity tandem, which is the base on which regulation will have to be set up for the next few years.

4.2. Internal and external adjustments for the NRA

Recent changes at ART essentially concerned the internal organization, which is now supported by an increased budget and a new team. Especially, the new direction implemented a specific vision of regulation, increasingly influenced by recent competition economic developments. These internal changes were also developed in a context of increasing embeddedness within international NRA's networks.

4.2.1. A new organization

ART's annual budget is currently set by the Minister in charge of the Economy, Finance and Industry. In 2004, budget increased by 10% (22 million dollars, PPP: 0.897; compared to 20,77 million dollars in 2003, PPP: 0.910). The decomposition of the budget is 56% on fixed expenses and 44% for variable expenses. The staff increased in the period 2003-2004 from 139 to 146, and kept a relatively low average age (41). In September 2003, ART considered possible changes to its organizational structure with a view to improving efficiency and adapting the organization to the new regulatory framework resulting from the transposition of the European directives into national law. The objective was to strengthen the economic skills and ability to adapt to the changing situation on the one hand, and to structure its activity around the key process of market analysis on the other. The new organization was put in place in February 2004. Together with these internal changes, professional training programmes and conference participation increased by 35% in 2003 for ART staff. Finally, by a decree of the President of the Republic, Paul Champsaur has recently been appointed chairman of the Autorité de Régulation des Télécommunications (ART). He replaced Jean-Michel Hubert whose six-year mandate ended on 3 January 2003. As a new director, Paul Champsaur impulsed a new policy at ART, largely influenced by recent economic developments in the domain of regulation and competition economics.

4.2.2. A new vision of regulation

New developments in competition (Laffont and Tirole, 2000) tend to sustain that competition in the telecommunications market has to favour the development of long-distance backbone frameworks to the customer. The simple explanation for this is the existence of a high degree of service sharing and data flows in the network backbone and high tariffs for long-distance calls. Hence, investment costs in network backbone can be amortized over many services and

in high margin segments. Two major consequences on the role of the NRA were involved from this proposition, and implemented at ART. Firstly, ART has to guarantee that the new entrant operator must be able to buy the services they cannot provide themselves from the incumbent operator. Secondly, ART has to check that the incumbent operator's retail tariffs must be gradually adjusted so as to create adequate economic space for the development of alternative operators. In practice (see ART 2004 annual report), this means that the control of wholesale tariffs is based on the principle of alignment of tariffs with costs (cost-oriented tariffs) and is carried out by annual approval of the interconnection catalogue. This control lies on transparency of the price charged by the incumbent, as well as multi-annual agreements between the incumbent and the regulator. Control in prices also operates at the retail level, and is based on prevention of anti-competitive practices, particularly those of dominant position. ART thus systematically prevents predatory pricing, price discrimination, or pre-emption of a new market.

The other domain that influenced a new vision of regulation at ART concerns the development of differentiation in services, or the development of proprietary access networks that can be interpreted as purely competitive behaviours, but in the meantime can also turn into segmentation, exclusivity and foreclosure. ART thus developed new procedures, in conjunction with competition authorities, to systematically detect the emergence of these anti-competitive behaviours.

4.2.3. Increasing embeddedness within international NRAs' networks

External exchanges are also fostered by an increasing embeddedness within networks composed of national regulatory authorities. Within these networks, NRAs can confront their past experience of liberalization, and also enlarge their vision of regulation by a better

knowledge on companies, technologies, and associated services. ART is involved in two major networks: COCOM (Electronic Communications Committee), and IRG/ERG (Independent Regulators Group/European Regulators Group). These networks regroup a large number of NRAs and are involved in three essential tasks: standardisation, in conjunction with ETSI (European Telecommunications Standardization Institute); access to electronic communications for disabled people; and definition of relevant markets and competitive behaviours on these markets.

5. CONCLUSION

In this chapter, we have described various factors that, to us, contribute to explain the current performance of France in broadband. These factors explicitly include industrial dynamics into the FISI. Alternatively, one could logically consider that the absence of these factors should also explain the lower/higher performance of other countries. In what follows, we advance some (non-exhaustive) arguments on this issue.

Among the factors that have tended to stimulate performances in the development and growth of broadband in France is certainly the early introduction of competition, both at the level of technologies and companies. In the meantime, however, the fierce and uncoordinated process of competition that was introduced generated the dominance of the incumbent technology, and the underdevelopment of alternative technologies. Thus, in the French case, competition favoured innovation, but not necessarily varied innovation, and this may limit opportunities for future growth.

In this perspective, the general tendency to develop a new vision of regulation, highly connected to new recommendations in the domain of competition policy, may also lead to the assimilation of the broadband industry, which is still in its development phase, to a mature industry. Over the recent years, this assimilation has not been yet completed in France, since ART was largely inspired by the broadband success observed in countries such as Japan or Korea. The development of alternative, competing networks and technologies was encouraged, though sometimes with unsuccessful results, together with the implementation of drastic obligations from the incumbent concerning the access to local network.

However, the compatibility and sustainability of this regulation policy in France is still largely dependent on the European new regulatory framework, and on how the different NRAs representing different countries with different stages of development in broadband may themselves integrate the legal framework and judicial procedures. In view of recent changes implemented in France, the recurrent dilemma of promoting competition or protecting the (national or European) competitors still apparently applies. This also shows that, if in each country, industrial dynamics in the domain of broadband shapes and is shaped by the NISI, yet the European info-communications system of innovation (EISI) which is still under construction will definitely transform the growth of broadband industry of member states. The way in which this transformation will operate is however complex and still difficult to anticipate.

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EXHIBITS

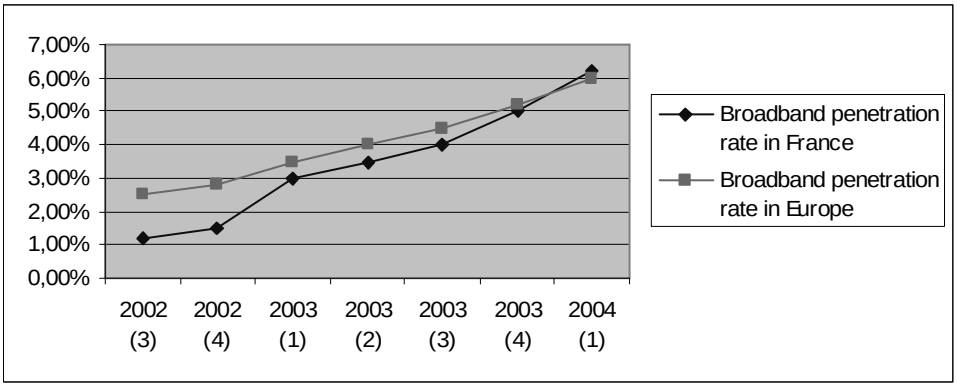

Exhibit 1: Broadband penetration rate in France and Europe from 2002 to 2004 (source: ART)

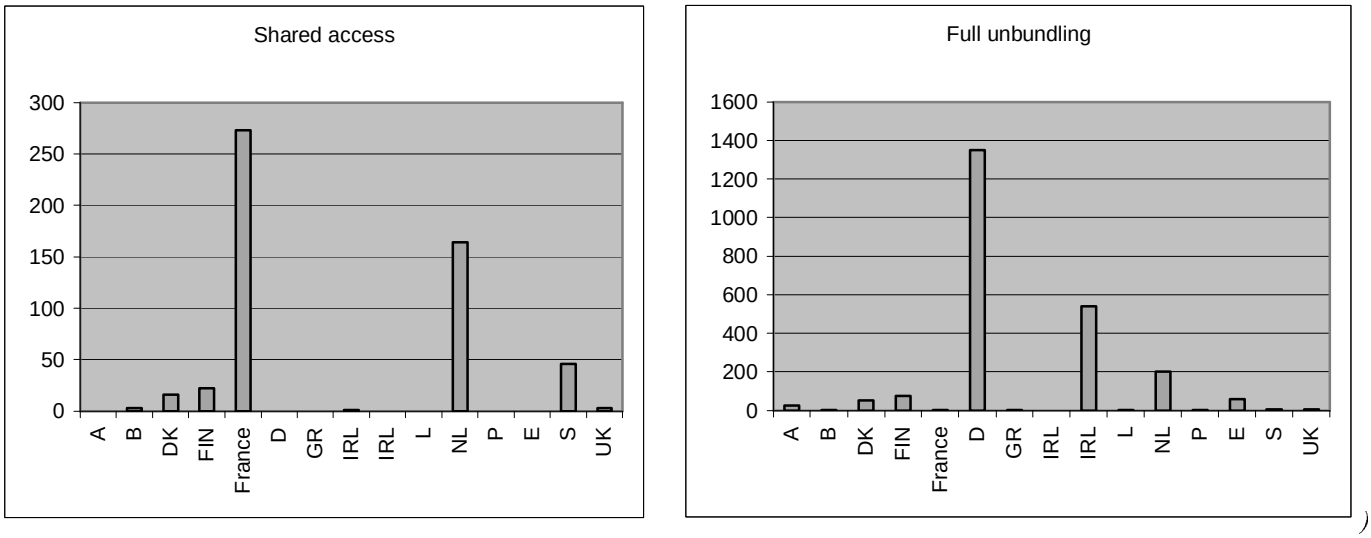

Exhibit 2: Shared access and Full unbundling in Europe in 2004 (source: ART)

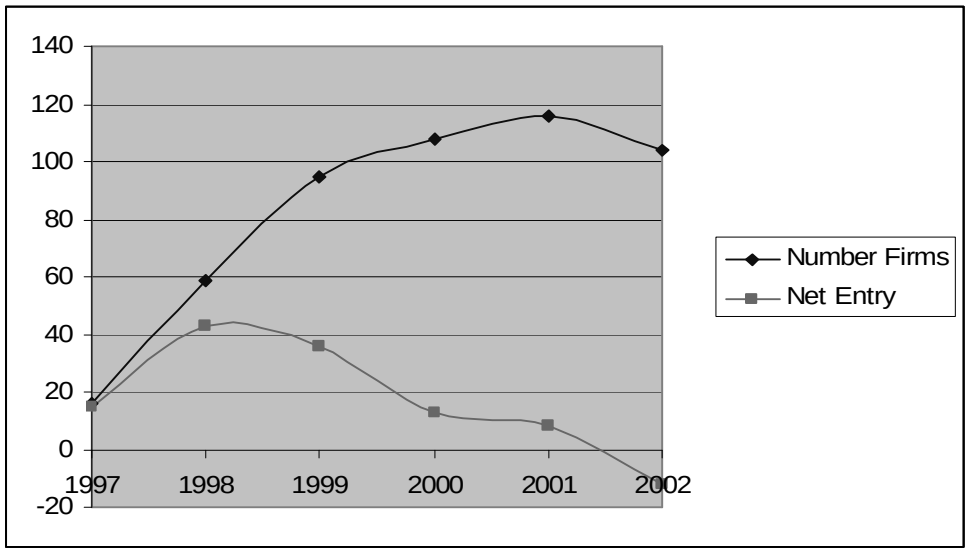

Exhibit 3: Number of firms and net entry in the French telecoms industry from 1997 to 2002 (source: author)

Regions/Areas /Clusters	Info-coms firms	Total firms	Firms specialization	Info-coms employment	Total employment	Employment specialization
France	45,694	2,870,888	1.5	876,325	15,443,000	5.6
Ile de France	8,870	662,674	1.3	255,502	5,042,724	5.7
PACA	4,500	283,106	1.5	32,000	1,576,085	2.0
Rhône Alpes	4,000	292,885	1.3	60,000	2,263,018	2.6
Aquitaine	2,018	148,959	1.3	21,000	1,105,435	1.9
Bretagne	719	119,497	0.6	22,483	1,112,583	2.0

Exhibit 4: Concentration of info-communications firms and employment in France (2002) (source: author)